TABLE 33.—Continued

	Snuff use	Chewing tobacco use	Any smokeless tobacco use
South Carolina	0.7	5.3	6.1
Georgia	1.4	7.3	8.7
Florida	1.1	1.9	2.9
East South Central Division	2.7	9.4	11.6
Kentucky	3.2	11.2	13.6
Tennessee	1.7	9.3	10.3
Alabama	1.7	6.6	8.3
Mississippi	5.7	11.4	16.5
West South Central Division	4.0	5.5	9.1
Arkansas	6.0	9.5	14.7
Louisiana	2.5	5.8	8.0
Oklahoma	4.8	6.7	11.0
Texas	4.0	4.6	8.2
West Region	1.4	3.3	4.5
Mountain Division	2.3	5.4	7.5
Montana	5.5	8.3	13.7
Idaho	2.3	6.7	8.7
Wyoming	3.4	13.0	15.8
Colorado	1.2	6.4	7.5
New Mexico	5.3	5.2	10.2
Arizona	2.0	3.8	5.4
Utah	0.9	3.0	3.7
Nevada	1.5	2.8	4.3
Pacific Division	1.0	2.6	3.4
Washington	1.8	6.1-	7.1
Oregon	2.7	5.4	7.6
California	0.7	1.7	2.3
Alaska	2.5	6.3	8.8
Hawaii	0.2	0.4	0.7

SOURCE: CPS 1985 (Marcus et al., in press.)

From 1964–86, there was an 80-percent decline in prevalence of both cigar and pipe smoking among men (Figure 7). The prevalence of cigar smoking declined from 29.7 to 6.2 percent; the prevalence of pipe smoking declined from 18.7 to 3.8 percent. Reasons cited to explain the drop in cigar sales include the effects of the antismoking campaign (several airlines have completely banned cigar and pipe smoking on all flights for many years, but only one airline has done so for cigarette smoking), declining image of cigar smoking, failure to attract new smokers, insufficient free-sample distribution, mediocre advertising and promotional activities, and declining quality of the product (Lazarus 1979).

TABLE 34.—Cigar/pipe smoking status (%) by major sociodemographic variables, United States, 1986

	Cigar/pipe smoking status				Sample size
	Current user	Former user	Never user	Total	
Total	4.3	22.2	73.5	100	13,031
Sex					
Male	8.7	41.8	49.6	100	6,377
Female	0.3	4.5	95.2	100	6,654
Age					
17–19	1.5	13.6	85.0	100	560
20–24	2.0	16.6	81.4	100	1,086
25–44	4.4	22.2	73.3	100	5,802
45–64	5.9	26.5	67.6	100	3,616
≥65	3.9	22.6	73.5	100	1,967
Race					
White	4.4	23.4	72.2	100	11,563
Black	3.7	13.9	82.4	100	1,096
Other	3.5	19.4	77.1	100	372
Region					
Midwest	4.8	22.6	72.6	100	3,236
Northeast	4.6	19.6	75.7	100	2,968
Southeast	3.8	23.2	73.0	100	4,301
West	4.1	22.7	73.2	100	2,526
Marital status					
Married/cohabiting	4.8	25.3	69.9	100	8,364
Widowed	1.8	8.9	89.2	100	1,011
Divorced/separated	5.6	20.1	74.3	100	1,446
Never married	2.8	17.7	79.4	100	2,179
Unknown	12.4	27.5	60.1	100	31
Education					
≤11 years	4.9	22.8	72.3	100	2,431
12 years	3.6	20.0	76.5	100	4,872
13–15 years	3.9	22.5	73.6	100	3,118
≥16 years	5.3	26.0	68.7	100	2,610

TABLE 34.—Continued

	Cigar/pipe smoking status				Sample size
	Current user	Former user	Never user	Total	
Household income (dollars per year)					
<10,000	3.1	16.8	80.1	100	1,220
10,000–19,999	4.0	21.2	74.9	100	2,204
20,000–29,999	4.3	23.1	72.6	100	2,853
30,000–39,999	5.0	24.2	70.8	100	1,735
≥40,000	5.5	28.1	66.4	100	2,947
Unknown	3.3	17.1	79.6	100	2,072
Poverty level[a]					
Above	4.7	23.9	71.4	100	9,913
Below	3.0	18.6	78.3	100	1,046
Unknown	3.3	17.1	79.6	100	2,072

[a]Poverty level is based on the definition provided by the U.S. Bureau of the Census.
SOURCE: AUTS 1986 (US DHHS, in press, a).

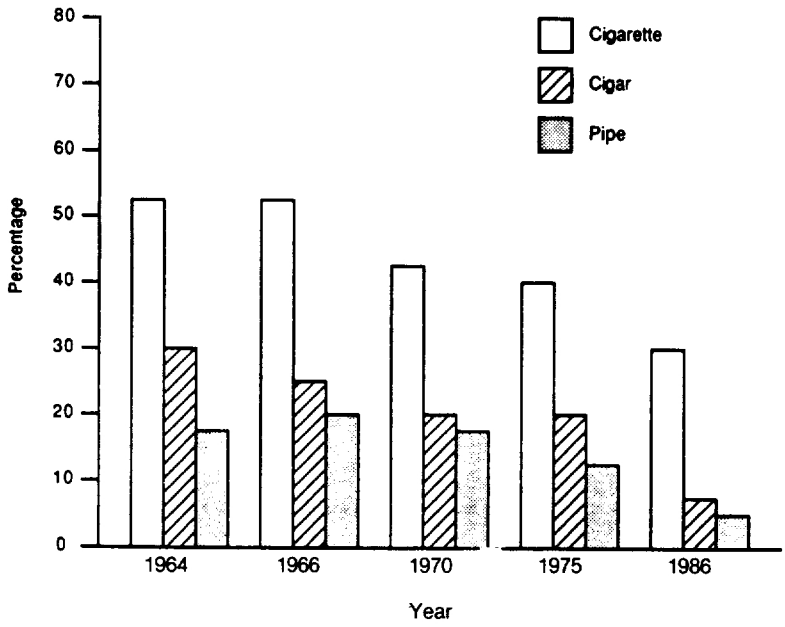

FIGURE 7.—Trends in prevalence of using cigarettes, cigars, and pipes, adult men, United States, 1964–86
SOURCE: AUTSs (US DHHS 1988).

PART II. CHANGES IN KNOWLEDGE ABOUT THE DETERMINANTS OF SMOKING BEHAVIOR

Introduction: Historical and Conceptual Overview

This Section reviews the past 25 years' growth in scientific knowledge of the determinants of smoking. Broad conceptual shifts in understanding smoking are first reviewed by comparing current knowledge, as reflected in the 1988 Surgeon General's Report as well as in more recent investigations, with that reflected in two previous Surgeon General's Reports during the past 25 years: the 1st Report, issued in 1964, and the 15th Anniversary Report, issued in 1979.

1964 Surgeon General's Report

The first Surgeon General's Report devoted a chapter to the psychosocial aspects of smoking and another to the issue of smoking as drug addiction or drug habituation. These topics continue to receive contemporary attention. A third chapter in the 1964 Report discussed morphological characteristics of smokers as important determinants of smoking (e.g., physique, somatotype, and weight). With the exception of body weight, there has been a decline in the attention paid to these variables. The relationship between body weight and smoking cessation, especially among women, has received much recent attention (US DHHS 1988).

The 1964 Report's Chapter on Psychosocial Aspects of Smoking related smoking to a variety of demographic factors including socioeconomic status (smoking being more prevalent among "lower or working classes" but less prevalent among extremely poor, e.g., unemployed groups) and gender (smoking being more prevalent among men). With regard to gender, the Report anticipated contemporary concerns about smoking by women (US DHHS 1980b), noting that "The proportion of women smokers has increased faster than that of men smokers in recent years" (US PHS 1964, p. 363).

The 1964 Report's chapter on psychosocial aspects also linked smoking to such broad personality factors as extraversion and orality. While some research continues to show relationships with extraversion (e.g., Eysenck 1980; Mangan and Golding 1984), most contemporary research focuses on more specific psychological, biological, and social variables and their interactions. The 1964 Report noted that smoking might function to reduce tension but reported little research related to this possibility. In contrast, the 1988 Report on nicotine addiction reviews considerable laboratory and field research on the relationship between smoking and stress and concludes that stress increases cigarette consumption among smokers and is related to initiation of smoking among adolescents and relapse among abstainers (e.g., US DHHS 1988).

The 1964 Report devoted much attention to the role of nicotine in smoking behavior, an issue that continues to be of central interest, as reflected in the 1988 Report. Both reports concluded that nicotine is a critical and substantial determinant of smoking. The focus in 1964, however, centered on whether smoking fit the World Health Organization's (WHO) definition of addiction, which emphasized the importance of physical dependence (WHO 1957). The Report concluded that there was no proof of

physical dependence and that smoking was a habit, as was use of cocaine, amphetamines, and other drugs. More recent perspectives (e.g., Pomerleau and Pomerleau 1984), culminating in the 1988 Report, have integrated psychosocial and pharmacologic processes into a single model of addiction or dependence. The 1988 Report demonstrated that there have been substantial data amassed since 1964 that confirm that by the criteria defining addiction, nicotine should be categorized as addicting.

Although the 1964 Report did conclude that "... there is no single cause or explanation of smoking ..." (US PHS 1964, p. 376), its discussion of research reflected an expectation that one or a very few key causes of smoking might be found. Along these lines, the Report emphasized the extent to which evidence demonstrated a cause to be sufficient. For example, in discussing evidence that smoking as a sign of masculinity may motivate many men to smoke, it labeled as "troublesome" the fact that "... some, but not so many others choose this particular means [that is, smoking] of giving evidence of their masculinity" (US PHS 1964, p. 373). Since the 1964 Report, models of causal inference in the behavioral sciences have changed to emphasize multiple causes interacting to bring about complex behavior patterns, and not one cause in itself that is necessary or sufficient.

1979 Surgeon General's Report

The 1979 Report gave much attention to prevention and to the determinants of smoking and smoking cessation, devoting 9 of 23 chapters to these topics. Thus, there was recognition of different stages of smoking behavior and of determinants varying as the stages change. Since the 1979 Report, researchers have continued to elaborate on multiple stages in the development and cessation of smoking.

The 1979 Report also recognized that multiple factors interact to encourage and support smoking. The Chapter "Behavioral Factors in the Establishment, Maintenance and Cessation of Smoking" posited smoking as "... a behavior—a highly complex act ... based on various biochemical and physiological processes ..." (US DHEW 1979a, pp. 16–25). It included research on drug and nondrug factors and called smoking "the prototypical substance-abuse dependency." The Chapter "Smoking in Children and Adolescents: Psychosocial Determinants and Prevention Strategies" explicitly viewed the initiation of smoking as determined by an array of factors. Likewise, the Chapter "Psychosocial Influences on Cigarette Smoking" linked multiple factors to maintenance and cessation of smoking, including personality characteristics, multiple drug use, coexisting chronic disease, price "elasticity" of consumer demand for cigarettes, and differences among cultures in their attitudes toward smoking as personal gratification. The importance of identifying multiple, interacting factors had been enunciated by Schwartz and Dubitzky in 1968 in their research on smoker profiles and the influence of multiple variables on smoking cessation, maintenance of cessation, and relapse (Schwartz and Dubitzky 1968).

The 1979 Report's recognition of an array of determinants was reflected in a recommendation for future research: "There are multiple psychosocial influences on cigarette smoking. Multivariate research is needed ..." (US DHEW 1979a, pp. 18–25). Multiple regression analyses and causal modeling have now become much more common in

smoking research (e.g., McAlister, Krosnick, Milburn 1984; Mosbach and Leventhal 1988).

The 1979 Report also was noteworthy in focusing attention on systematic cessation efforts, taking both pharmacologic and psychosocial factors into account. The extensive treatment of cessation research in a separate chapter was a first for the Surgeon General's Report and set a precedent for reviewing the intervention literature in subsequent reports.

Current Views

Current explanations assume that smoking is determined by multiple causes, no one of which is sufficient. The interplay of psychosocial and pharmacologic forces continues to occupy investigators of nicotine addiction as it does investigators of other drug addictions. While the 1964 Report tended to see such factors as mutually exclusive, the 1988 Report (US DHHS 1988) viewed these various pharmacologic, biochemical, and psychosocial processes, such as conditioning, as interacting in the determination of nicotine addiction. In fact, conditioned drug-taking behavior is now thought to be central to the concept of addiction; physical dependence is neither necessary nor sufficient (US DHHS 1988). The biological power of nicotine may make the learned behaviors that form smoking patterns stronger and more resistant to change. At the same time, the plentitude of daily circumstances, activities, and emotions to which smoking is conditioned ties this behavior to numerous rituals of daily life and contributes to the difficulty of breaking this addiction (Fisher, Bishop et al. 1988a; Pomerleau and Pomerleau 1987; Russell, Peto, Patel 1974; US DHHS 1988). This interplay between behavior and the pharmacologic effects of nicotine is mirrored in research on smoking cessation, in which nicotine-containing chewing gum and behavioral interventions have been shown to enhance one another (e.g., Hall et al. 1985; Killen, Maccoby, Taylor 1984; Schneider et al. 1983). In reviewing the evidence for defining smoking as an addiction, the 1988 Report made the important point that the interplay between social, behavioral, and pharmacologic factors that define tobacco addiction is similar to that seen with other drug addictions.

The continuum of smoking behavior can be viewed as occurring in different stages. The 1964 Report identified two stages (or processes): "Taking Up" and "Discontinuation." Current work identifies three major stages—development, maintenance of regular smoking, and cessation. Several investigators have offered descriptions of various smaller stages within smoking development (e.g., Leventhal and Cleary 1980; Flay et al. 1983). These include, for example, preparation, initiation, experimentation, and transition to regular smoking (Flay et al. 1983). Similarly, the process of cessation has been specified in smaller stages (e.g., Marlatt 1985; Prochaska and DiClemente 1983; Rosen and Shipley 1983). These include, for example, precontemplation (not yet considering quitting), contemplation, action, and maintenance or relapse (Prochaska and DiClemente 1983).

Evolution of theoretical models of stages in smoking over the past 25 years is depicted in Figure 8, indicating the stages described around three periods of time, the 1960s,

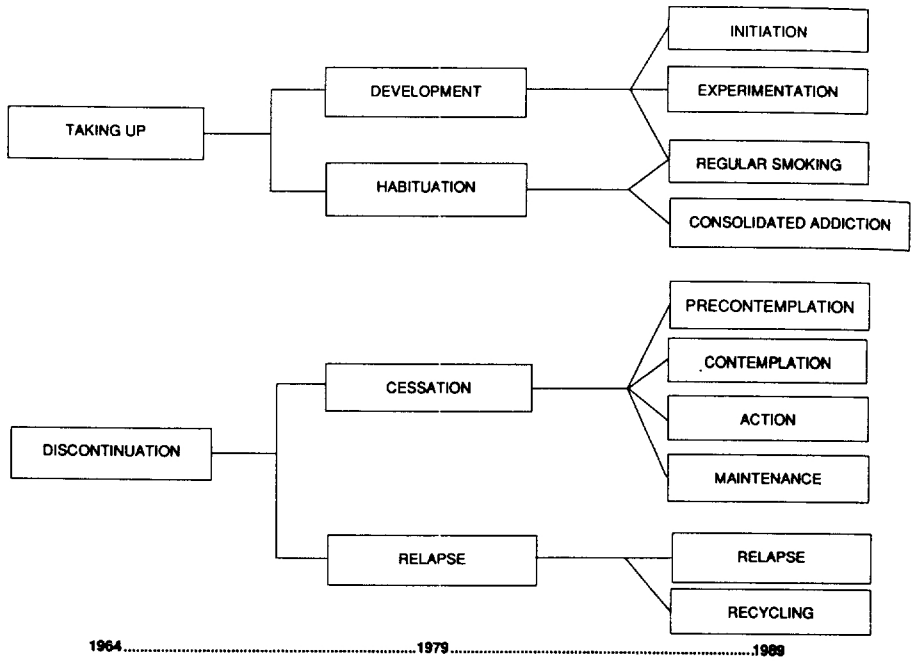

FIGURE 8.—Evolving theoretical concepts of the natural history of smoking, 1964–89

1970s, and 1980s. In 1964, only two broad stages were noted, while in 1989, as many as nine can be observed.

Stages are not explanations of attitudes or behaviors. For example, precontemplation is a description of the attitudes toward smoking and likely responses to antismoking messages of the individual uninterested in stopping. It is not an explanation or a cause of that lack of interest. Neither the sequence of stages nor the boundaries among them are rigid. For example, a young experimenter may stop smoking without ever making the transition to regular smoking. A smoker in the regular smoking stage is, at the same time, a precontemplator or contemplator in the cessation stage. The regular smoking stage is abandoned when the smoker moves into action and stops smoking. Although the boundaries among stages and their sequence may be blurred, the concept serves as a framework for understanding the determinants of smoking behavior. Different determinants are operative to different degrees during each stage.

The three broad stages of smoking and their multiple interacting determinants provide the organization for the remainder of this Chapter. Within the stage framework, historical trends in determinants are discussed primarily within three general domains. The three domains do not constitute a model; they are a useful way to organize the determinants of smoking. The first domain is composed of pharmacologic processes and conditioning, the basic factors that interact to support smoking. The combining of these into one domain reflects present awareness that pharmacologic processes and conditioning interact to produce addiction (US DHHS 1988). The second domain includes cognition and decisionmaking. The stages of smoking reflect appraisals of oneself, of social experiences, and of information, such as that presented in campaigns to deter

smoking. The ways in which individuals process such information and make choices about smoking have been the foci of substantial research. The third domain includes personal characteristics (e.g., personality and demographic factors) and social context, which includes the important influences of the social, cultural, and economic environment. Personal characteristics themselves are affected by these environmental influences and mediate their effect rather than independently determine smoking.

Table 35 presents some of the determinants, within each of the domains, that have a strong effect on the indicated stage of smoking. As such, the table provides an outline of the discussion that follows.

Development of Smoking

Pharmacologic Processes and Conditioning

Historically, little attention was paid to the role of pharmacologic effects of nicotine and conditioning in the initial development of smoking behavior. For example, among teenagers, psychosocial determinants have been assumed to play a dominant role (Table 35), as for other dependence-producing substances. Once a smoker starts to inhale, however, it is possible that the pharmacologic properties of nicotine contribute to continued smoking (Kozlowski 1988). A few studies have investigated the potential role of individual-specific psychophysiological responses to nicotine and the development of smoking (Kozlowski and Harford 1976; Silverstein et al. 1982). Reactions to initial cigarettes and the interpretation of these reactions may predispose individuals to continuing or not continuing smoking. Hirschman, Leventhal, and Glynn (1984), for example, found that the initial early physical reaction was predictive of continued smoking. Dizziness was related to a rapid progression to a second cigarette, while coughing and a sore throat were related to discontinuation.

It is not clear how long it takes for the transition from experimental to regular smoking, and there is likely to be much variation (e.g., Hirschman, Leventhal, Glynn 1984). However, results from several recent studies suggest that teenagers become more addicted to smoking than was previously believed. Survey data (Green 1979; Johnson 1986) indicate that teenagers make frequent and often unsuccessful quit attempts. Other studies confirm that teenagers have difficulty stopping and report reasons for the difficulty—social pressure, urges, withdrawal symptoms—similar to those seen with adults (Biglan and Lichtenstein 1984; Hansen et al. 1985; Weissman et al. 1987). Because smoking among children and adolescents is generally confined to relatively few situations, the level of nicotine dependence is limited in this group. Nevertheless, the reports of withdrawal symptoms and relapses among teenage smokers attest to the strength of nicotine dependence even among those still in the early stages of smoking.

More work is needed in this area to facilitate our understanding of the development of smoking addiction. Research on adolescent initiation has not applied the same biobehavioral concepts and measurement tools (e.g., plasma nicotine or cotinine levels) as have been applied to adult smoking. Sensitive human subjects issues related to work-

TABLE 35.—Determinants of smoking within each domain by stage

Domain	Stage		
	Onset/development	Regular use	Cessation
Pharmacologic processes and conditioning	Initial psychopharmacologic effects encourage transition from experimental to regular use	Numerous conditioned associations among smoking, environmental events, and pharmacologic effects of nicotine	Withdrawal symptoms and conditioned and reinforcing effects of nicotine encourage relapse
Cognition and decision-making	Poor awareness of long- and short-term health consequences and addictive nature of smoking	Health consequences are minimized or depersonalized	Increased awareness of smoking-related symptoms or illness
	Positive characteristics are attributed to smokers and smoking	Positive characteristics are attributed to smokers and smoking	Perceived benefits of cessation
			Belief in one's ability to stop
Personal characteristics and social context	Inclination toward problem behaviors	Stress/negative affect are reduced by nicotine	Social norms and support for stopping and maintained abstinence
	Extraversion	Social acceptability and peer and family norms support continued smoking	Skills for coping with stimuli associated with smoking
	Peer and family norms and values support smoking	Cigarette marketing encourages and legitimizes smoking	Economic, educational, and personal resources to minimize stress and maintain cessation
	Youth-oriented advertising		

ing with minors must be resolved; these have slowed understanding of how dependence develops.

Cognition and Decisionmaking

Knowledge of the health effects of smoking is likely to influence initiation for some teenagers. Teenagers reported that one-third of their earliest refusals of cigarettes were based on fear of the effects of smoking on health, attractiveness, or athletic performance (Friedman, Lichtenstein, Biglan 1985). In early adulthood, British medical students' rating of smoking as a "major" or "not major" health risk was associated with their smoking status as reflected by surveys in 1972 and 1981 (Elkind 1982). Heavy smokers among college women evaluated health outcomes of smoking less negatively than did nonsmokers (Loken 1982). The latter two cross-sectional studies, however, may possibly reflect the effect of behavior on cognition rather than the effect of cognition on behavior.

Cognitive appraisals of the attractiveness or desirability of smoking or of smokers are associated with current smoking or intentions to smoke (Barton et al. 1982; McAlister, Krosnick, Milburn 1984), as are beliefs or attributions of the functional role of smoking (Murray and Perry 1984). Tenth graders inclined to smoke indicated greater congruity between the value they place on interest in the opposite sex and the extent to which they ascribe such interest to smokers (Barton et al. 1982). Intentions to smoke were also associated with congruity between the personal value of a characteristic and its attribution to smokers. Murray and Perry's analyses (1984) of the functional meaning of substance use by youth elucidated a variety of attributions correlating with young people's substance use. The report that smoking was useful for relieving boredom was most highly correlated with smoking. Data from England (Charlton 1984) demonstrate that children who smoke compared with nonsmoking children are more likely to agree that "Smoking keeps your weight down." This attribution was especially prominent among older girls.

School health education programs to discourage smoking have traditionally assumed that knowledge of the health consequences of smoking would deter adolescents from smoking (Chapter 6). This assumption has received limited support in the prevention literature (Thompson 1978). Despite school health education programs, children, especially those who smoke, continue to harbor several misconceptions about smoking. These misconceptions include overestimating the prevalence of both peer and adult smoking, underestimating the negative attitudes of their peers, and minimizing the addictive nature of smoking (Leventhal, Glynn, Fleming 1987). The overestimating of prevalence may represent the combined influence of social context and cognitive factors in determining smoking.

Contemporary smoking prevention programs ("psychosocial prevention curricula") emphasize knowledge of short-term consequences of smoking likely to be more pertinent to adolescents who have limited future orientations (Glasgow et al. 1981), and knowledge about the variety of social influences (parental, peer, and media) that affect the development of smoking (Flay 1985; Evans et al. 1978; Chapter 6). Decisionmak-

ing skills (Botvin and Wills 1985) and analysis of cigarette marketing strategies (Evans et al. 1978) also are now taught to help youth make more informed choices.

Personal Characteristics and Social Context

Personal Characteristics

The 1964 Surgeon General's Report described as "one of the best designed studies" (US PHS 1964, p. 365) an investigation in which heavy smokers were found to be more extraverted than were medium smokers, who were in turn more extraverted than were light smokers (Eysenck et al. 1960). The 1964 Report also cited two other papers with similar findings (McArthur, Waldron, Dickinson 1958; Schubert 1960). More recent work by Cherry and Kiernan (1976, 1978) found that neuroticism and extraversion measured at age 16 were positively related to smoking status at age 25, suggesting a causal relationship. Their combined effects showed substantial ability to predict subsequent cigarette use. Eysenck (1980) has argued that the association between smoking and the personality dimensions of extraversion and neuroticism implies a constitutional predisposition for smoking analogous to that seen with other drug addictions (US DHHS 1988). Work on extraversion and smoking does seem to reflect a consistent relationship between them (US DHEW 1979a; Ashton and Stepney 1982).

Studies have linked initiation of smoking with rule breaking in school, general delinquency, age at first intercourse, inadequate contraceptive use, low levels of child compliance within the family, low levels of responsibility, nonconventionality, impulsivity, rebelliousness, and previous use of alcohol and other substances (Brook et al. 1983; Chassin et al. 1984; Jessor and Jessor 1977; Mittelmark et al. 1987; Russell 1971; Zabin 1984). Academic success, as measured by grade point average, is strongly linked to the rate of smoking (Johnson 1986). High school dropouts (Pirie, Murray, Luepker 1988) and high school seniors not planning to go to college (Johnston, O'Malley, Bachman 1987) are much more likely to smoke than are those planning higher education, and this difference has increased over the past 10 years (Table 20). Similar factors are observed with other drug addictions (US DHHS 1988). Jessor (1987) views this covariation as reflecting a problem behavior syndrome. Biglan and Lichtenstein (1984) questioned this interpretation, arguing against the inference of underlying personality factors to explain the acknowledged covariation among smoking and other problem behaviors.

Peer and Family Influences

The influences of peers and parents were considerations in the 1964 Report and remain a major contemporary issue (e.g., Krosnick and Judd 1982). Understanding of the effect of peers has increased since the 1964 Report noted little available evidence of their influence on the onset of smoking. It acknowledged that imitation ". . . may play a role in inducing some, and perhaps many children to take up smoking" (US PHS 1964, p. 372). Studies noted that children of smoking parents were more likely to smoke

than children of nonsmoking parents (NIH 1975; Wohlford 1970); and smoking teenagers were more likely to have friends who smoked than were nonsmoking teenagers (Gordon and McAlister 1985; Levitt and Edwards 1970). The chapter on children and adolescents in the 1979 Report (US DHEW 1979a) reviewed the influence of social learning theory on models of the initiation of new behavior. More recent studies have supported the importance of peer models (e.g., Antonuccio and Lichtenstein 1980; Kniskern et al. 1983). The 1988 Report discussed similar factors in the determination of other drug dependence.

The impact of peer smoking on adolescent smoking has been identified in a number of studies (e.g., Chassin et al. 1984; Hundleby and Mercer 1987; McAlister, Krosnick, Milburn 1984; Mittelmark et al. 1987), including their impact on initial smoking episodes (Friedman, Lichtenstein, Biglan 1985) and continuation of smoking among those who already have experimented with cigarettes (Biglan and Lichtenstein 1984). These influences seem to rest on the importance of modeling of smoking, as well as on the setting of norms among subgroups of adolescents. The importance of bidirectional influences in smoking and smoking cessation among young people has been noted by Chassin, Presson, and Sherman (1984). In some cases, a young person's membership in a particular peer group may expose him or her to the example to smoke or to quit; however, in other cases, a young person may actively seek membership in a peer group that represents or is consistent with his or her established intentions about smoking.

More recent research has both reaffirmed the importance of parent and peer influences and attempted to explore the points at which they exert their influence during the process from onset—the initial smoking episode—to regular use (e.g., Friedman et al. 1985; Hirschman, Leventhal, Glynn 1984). The literature has tended to underscore the role of parental example and influence for initiation of smoking by young children and adolescents, and the primacy of peer influences among older youth. In application, this emphasis has often translated into an almost exclusive intervention focus on the social influences of peers for older adolescents (see Chapter 6). Some of the intervention programs include peer leaders chosen by their classmates (Murray et al. 1987). Krosnick and Judd (1982) found no evidence for decreases in parental influences on smoking during adolescence, although they did find that peer influence increases during this period. These studies often include important methodological advances wherein interviews and self-monitoring are used to augment questionnaire data.

A growing body of literature implicates family climate or family interaction patterns in smoking. Family characteristics such as indifference, low levels of trust, parental restrictiveness, and low levels of parental involvement are associated with smoking as well as with marijuana and alcohol use (Hundleby and Mercer 1987). Other research has demonstrated that low levels of adolescent involvement in family decisionmaking predict subsequent experimentation with cigarettes among adolescents (Mittelmark et al. 1987). A variety of characteristics in fathers, including harsh criticism, impulsivity, stereotyped male interests, poor ego integration, and lower levels of interpersonal relatedness has also been demonstrated to be associated with a greater likelihood of sons' smoking (Brook et al. 1983). A decreased likelihood of sons' smoking was associated with paternal affection, emotional support, attentiveness, participation in meaningful

conversations, and higher expectations for the sons. It appears that adolescent smoking is more likely in restrictive, punitive, and unempathetic families in which children are uninvolved in decisionmaking. On the other hand, families who provide multiple avenues for identity formation and expression of feelings may obviate the utility of smoking or other problem behaviors as a mode of identity expression (Jessor 1987).

Personal characteristics and attitudes may mediate peer influence on smoking as well as other drug dependencies (US DHHS 1988). Research indicates greater impact of peer smoking among adolescents scoring low on a measure of obedience to parental authority and high on a measure of rebelliousness (McAlister, Krosnick, Milburn 1984). The interactions among social influences, personality, and smoking were highlighted in a study in which seventh and eighth graders described the informal reference or affiliation groups they observed among their schoolmates and identified the group with which they felt the closest affiliation (Mosbach and Leventhal 1988). Two of the four groups that emerged, "hot-shots" (78 percent female, popular leaders in academic and extracurricular activities) and "dirts" (63 percent male, characterized by problem behaviors such as drinking, poor academic performance, and cutting classes), were identified as primary reference groups by only 14.7 percent of respondents but accounted for 55.6 percent of the smokers. In discriminant function analyses, a "macho" dimension was highly associated with one high smoking prevalence group, the "dirts," but not with the "hot-shots." In contrast, academic and social leadership was associated with the "hot-shots" but not with the "dirts." As were the "dirts," the "jocks" were also 63 percent male and high on the macho dimension but low on use of both hard liquor and cigarettes. Adolescent smoking, then, is closely related to individual identification with groups, but these groups differ markedly in their association with other problem behaviors and psychosocial characteristics. Depending on group affiliation, different personality and attitudinal characteristics may be related to smoking.

Social class differences in the onset of smoking continue to be observed as noted in Part I of this Chapter. Racial differences in onset and prevalence and historical shifts in these differences are also well demonstrated in the first part of this Chapter. Sussman and colleagues (1987) in their study of psychosocial predictors of cigarette smoking onset by approximately 1,000 white, black, Hispanic, and Asian adolescents in Southern California demonstrated that different variables predict onset in these different groups. A good predictor for whites but not for other ethnic groups was adult and peer models of smoking behavior, while for blacks, risk-taking preference was a good predictor. These findings possibly reflect unique cultural and social contexts and suggest that tailoring socially relevant treatment components to adolescent subgroups may be beneficial (Sussman et al. 1987).

Cigarette Marketing

Beyond the family and peer group, an important social context determinant of the onset of smoking is the marketing of cigarettes. There have been longstanding concerns about the impact of cigarette advertising on both children and adults as evidenced by the ban on radio and television advertisements, effective in 1971. Yet, "cigarette

advertisements continue to appear in publications with large teenage readerships" (Davis 1987, p. 730).

Marketing campaigns seem designed to appeal to specific personality characteristics of groups of potential buyers. In this respect, they exemplify interactions between personal characteristics and the environment. The Marlboro brand was the leading choice of a group of white adolescent male (48 percent) and female (38 percent) smokers surveyed in Louisiana in 1981 (Hunter et al. 1986). In a sample of 306 high school students in Georgia, Marlboro was the preferred brand of 76 percent of smokers who identified a single preferred brand (Goldstein et al. 1987). Similar findings were reported by Glantz (1985). These figures contrast with the overall domestic market share of Marlboro, which was 24 percent in 1987 (Ticer 1988). Given the associations of rebelliousness and behavioral problems with adolescent smoking, as reviewed above, there may be a relationship between the noted disparity of overall brand preference and the emphasis on the tough independence of the "Marlboro Man." In fact, this pattern may be a reflection of extensive market segmentation, in which specific brands are marketed for specific gender or ethnic groups, often with campaign messages and symbols aimed at those groups (Davis 1987). Teenage girls, relative to boys, are more likely to believe that smoking controls weight (Charlton 1984) and are good targets for advertisements that emphasize the desirability of being slender (Gritz 1986).

Some market segmentation appears more subtle, guided by smoker characteristics not as apparent as race and gender. McCarthy and Gritz (1987) surveyed students in grades 6, 9, and 12 regarding their attitudes about cigarette advertisements. Among their findings was the closer relationship, for those youth more likely to be smokers, between personality self-ratings and personality ratings assigned to models in cigarette advertisements. Thus, the way adolescents see themselves appears to be related to their attraction to certain advertisements. This congruity among psychological correlates of teenage smoking, marketing themes, and teenage preferences is especially striking when one considers that the tobacco industry denies that campaigns are aimed at teenagers (Davis 1987).

Summary

The increased understanding of the multiple and interacting determinants of the development of smoking and of the relation of these determinants to the stages of development of smoking is a reflection of progress over the last 25 years. The delineation of stages—from onset to regular use—has been an especially influential development (Figure 2). The development of the addictive processes in teenagers has recently become better appreciated and understood (Biglan and Lichtenstein 1984; Hirschman, Leventhal, Glynn 1984). While information about the long-term disease consequences of smoking has an important role in adolescent smoking initiation, awareness of the short-term health consequences and the influence of peers and advertising are now seen as more critical for adolescent decisionmaking. The effects of peers and family are both supported. Cigarette marketing appears to target teenagers despite the cigarette companies' reported policy efforts to restrict such advertising.

Pharmacologic Processes and Conditioning

Pharmacologic processes and conditioning play complementary and major roles in maintaining regular smoking. Early theories of smoking tended to view pharmacologic processes and conditioning as separate explanations of regular smoking (e.g., Hunt 1970; Table 35). They are now viewed as complementary and interacting processes (US DHHS 1988). The 1988 Surgeon General's Report on nicotine addiction affirmed the critical role of nicotine and its varied and powerful pharmacologic effects on the central nervous system (CNS) in the development and maintenance of regular smoking. This acknowledgment and its implications for intervention represent a significant shift in perspective over the 25-year history of the Surgeon General's Reports. Concurrently, increased knowledge of smoking as an addiction has clarified the important role of conditioning in addiction. Conditioning and related processes link the biological effects of nicotine to the many behaviors that make up smoking and to the many concurrent physical and environmental stimuli that guide it.

Nicotine Addiction

The 1964 Report distinguished between drug addiction and drug habituation (US PHS 1964; Table 36) and concluded that smoking is habituation. As noted in the 1988 Report, the addiction/habituation distinction was dropped in 1964 by the WHO shortly after the release of the 1964 Report (US DHHS 1988).

The 1988 Surgeon General's Report on nicotine addiction noted the following three major conclusions: (1) cigarettes and other forms of tobacco are addicting; (2) nicotine is the drug in tobacco that causes addiction; (3) the pharmacologic and behavioral processes that determine tobacco addiction are similar to those that determine addiction to drugs such as heroin and cocaine (US DHHS 1988, p. 9). These conclusions were based on a thorough review of research on addictive aspects of smoking extending over nearly a century.

The criteria that guided the 1988 Report's conclusion that smoking is an addiction are summarized in Table 36. As documented by extensive research cited in the Report, smoking meets all the criteria. Smoking is continued despite a desire to quit and, in many cases, despite clear harm to the individual. A central criterion concerns psychoactive effects of a drug on the CNS. Rapid absorption of nicotine into the bloodstream and consequent delivery to the CNS are features common to all popular forms of tobacco use. Recent evidence confirms that nicotine is absorbed by the brain, which contains receptors specific for this agent (e.g., London et al. 1985; London, Waller, Wamsley 1985); has euphoric effects and perhaps sedative or other anxiolytic effects mediated by neurohormonal processes (e.g., Henningfield, Miyasato, Jasinski 1985); and reinforces behavior, even among animals or human subjects blind to whether they received saline placebo or nicotine (Henningfield, Chait, Griffiths 1983, 1984). As with other addictive drugs, prolonged ingestion of nicotine leads to tolerance, a tendency to consume increasing amounts of a drug, presumably to achieve a desired euphoric or

TABLE 36.—Comparison of characteristics of addiction, habituation, and dependence in 1964 and 1988 Surgeon General's Reports

Characteristics of drug addiction and habituation in 1964 Surgeon General's Report[a]		Characteristics of drug addiction in 1988 Surgeon General's Report[b]
Drug addiction	Drug habituation	Primary Criteria
A state of periodic or chronic intoxication produced by the repeated consumption of a drug (natural or synthetic).	A condition resulting from the repeated consumption of a drug.	Highly controlled or compulsive pattern of drug use.
Its characteristics include:	Its characteristics include:	Psychoactive or mood-altering effects involved in pattern of drug taking.
(1) an overpowering desire or need (compulsion) to continue taking the drug and to obtain it by any means;	(1) a desire (but not a compulsion) to continue taking the drug for the sense of improved well-being it engenders;	Drug functioning as reinforcer to strengthen behavior and lead to further drug ingestion.
(2) a tendency to increase the dose;	(2) little or no tendency to increase the dose;	Additional Criteria
(3) a psychic (psychological) and generally a physical dependence on the effects of the drug; and	(3) some degree of psychic dependence on the effect of the drug, but absence of physical dependence and hence of an abstinence syndrome; and	Tolerance (increased doses either tolerated without discomfort or needed to achieve desired effects).
(4) detrimental effects on the individual and on society.	(4) detrimental effects, if any, primarily on the individual.	Physical dependence (withdrawal syndrome upon termination of drug taking).
		Use despite harmful effects.
		Pleasant (euphoric) effects.
		Stereotypic patterns of drug use.
		Relapse following drug abstinence.
		Recurrent drug cravings.

[a]SOURCE: US PHS (1964, p. 351).
[b]SOURCE: US DHHS (1988, pp. 194, 250–253).

other effect. Prolonged use also leads to physical dependence, as indexed by various psychological and physical withdrawal symptoms following cessation of smoking. The inclusion of tobacco dependence as a disorder in the Diagnostic and Statistical Manual of Mental Disorders III, the official diagnostic reference for the American Psychiatric Association (1980), was another major marker in the shift of scientific opinion about the addictive nature of cigarette smoking.

Central to the 1964 view was the distinction between compulsive use (addiction) and the less compulsive "desire" (habituation). The difference was noted to rest primarily on the source of the desire or compulsion. The 1964 Report emphasized "serious personality defects from underlying psychologic or psychiatric disorders" (US PHS 1964, p. 351) as a defining factor in compulsive use and therefore in addiction. Evidence gathered since the early 1960s contradicts the assumptions that underlying pathology drives the compulsive use seen in addiction. Drugs commonly viewed as addictive, e.g., heroin, may be abandoned with little apparent effort as with many Vietnam veterans addicted to heroin who gave it up after their return to the United States (Robins, Helzer, Davis 1975; US DHHS 1988). On the other hand, the extent to which smoking can be highly compulsive is suggested by its continuance in the face of substantial awareness of its harm, as by cardiac patients (Baile et al. 1982; Burling et al. 1984; Ockene et al. 1985; US DHHS 1984). The generality of nicotine's effects argues against its compulsive use resting on individual psychopathology; the basis for nicotine addiction rests on the interaction of conditioning processes and nicotine action in the brain.

Mechanisms of Nicotine Action

Much research in the 1970s on the behavioral effects of nicotine has been guided by the nicotine regulation (or titration) model put forth over the years by Jarvik (1977), Jarvik, Glick, and Nakamura (1970), Russell (1976), and Schachter, Silverstein and colleagues (1977). According to this model, smokers regulate their smoking to maintain a certain level of blood nicotine within a range of upper and lower limits (Herman and Kozlowski 1979; Kozlowski and Herman 1984). This includes the avoidance of withdrawal symptoms or anticipated withdrawal by maintaining a nicotine level above a lower limit and avoidance of toxicity by maintaining it below an upper limit.

This formulation has been criticized as failing to explain the self-perceived positive effects or benefits of smoking that may promote use (Pomerleau and Pomerleau 1984; Leventhal and Cleary 1980). Interestingly, the 1964 Surgeon General's Report devoted only 1 1/2 pages to such effects. In the last few years, several investigators (e.g., Ockene et al. 1988; Pomerleau and Pomerleau 1984) have proposed that smoking, by virtue of the varied actions of nicotine, provides several positively perceived effects and is employed by many smokers as a responsive and effective coping strategy. This implies that smokers can be reinforced for continued smoking without maintaining a minimum blood nicotine level. The 1988 Report devoted an entire chapter to this topic.

An influential and historically important model of perceived positive effects of smoking stressed the psychological effects of nicotine and other pharmacologic aspects of smoking (Pomerleau and Pomerleau 1984). This model holds that nicotine increases the release of a number of neuroregulatory hormones, conferring on smoking the ability

to act as stimulant or sedative depending on level of ingestion, background hormone levels, and the like. Nicotine thus can serve to reduce anxiety or produce euphoria (US DHHS 1988) and enhance vigilance for certain cognitive tasks (e.g., Warburton et al. 1986). The work of Grunberg (1986; US DHHS 1988) also suggests that nicotine may aid smokers in maintaining lower body weight. Although objective judgment indicates that the health effects of smoking are more important than the weight maintenance effects (Abrams et al. 1987), the latter seem to be of particular importance to some women (Klesges and Klesges, in press; US DHHS 1988). This growing recognition that smokers may value several effects of cigarettes can be used not so much to justify the behavior but rather to direct intervention strategies (e.g., physical activity) that might help people meet needs previously served by cigarettes. Interventions also are likely to be seen as more credible to smokers if the coping value of cigarettes is recognized (Ockene et al. 1988).

Conditioning and Smoking

What most distinguishes recent analyses of the conditioning of smoking from earlier views (e.g., Hunt 1970) is their emphasis on the conditioning of the biological effects of nicotine. The occurrence of stimuli previously associated with the effects of nicotine will tend to evoke responses related to those effects or cues for further consumption (e.g., Abrams et al., in press; Herman 1974; Niaura et al. 1988; Rickard-Figueroa and Zeichner 1985). Such conditioned effects may link smoking to aversive states alleviated by nicotine. For example, investigations described earlier (e.g., Schachter, Silverstein et al. 1977) suggested that smoking covaries with stress, which is hypothesized to deplete nicotine. Leventhal and Cleary (1980) suggested that stress as well as other emotions may be alleviated by nicotine and would then come to serve as cues for smoking. Pomerleau and Pomerleau (1984, 1987) identified neurohumoral effects of nicotine as the paths of its impact and elaborated on the ways such effects might be conditioned to circumstances surrounding smoking so as to regulate it in the future.

Two influential theories of addiction emphasize the role of relief of withdrawal or anticipated withdrawal in smoking. As suggested by Wikler's classic work with opioids (Wikler 1973; Wikler and Pescor 1967), withdrawal symptoms may be conditioned to the circumstances in which they occur. This would set the stage for stimuli associated with prior drug taking to elicit withdrawal symptoms and urges. With smoking, greater withdrawal symptoms have been noted when cessation occurs in natural rather than artificial environments, presumably because those natural environments contain numerous cues associated with prior smoking (Hatsukami, Hughes, Pickens 1985). Within this model, return to smoking after brief or extended abstinence is reinforced by the reduction in such conditioned withdrawal symptoms.

Opponent-process theory (Solomon and Corbit 1973) suggests that the reduction of aversive withdrawal symptoms may be the result of the interaction of the immediate response to a drug, called the "A" state, and the delayed response, the "B" state. The B state is "opposed" to or opposite the A—hence "opponent process"; if the A is pleasurable, the B will be aversive. Initially, the A state is stronger. While initial, pleasurable responses to nicotine may encourage increased smoking, regular smoking

leads the aversive B state to become stronger, which in turn may be reduced or avoided by the A-state consequences of further smoking. After regular smoking has been established, the A state serves only to avoid or reduce the aversive B state. That is, regular smoking is pursued to reduce displeasure rather than to bring about the pleasure that may have been its initial appeal. It is important to note that there is little evidence on the validity of the Wikler theory or opponent-process theory as applied to smoking.

In contrast to models emphasizing relief of withdrawal, a recent review (Niaura et al. 1988) proposes an "appetitive" model of responses to cues associated with smoking. Evidence indicates that cues surrounding smoking are more strongly conditioned to its positively perceived effects than to withdrawal symptoms. That is, cues associated with intake of nicotine (e.g., holding a cigarette or inhaling) come to elicit conditioned responses similar to the effects of nicotine (e.g., relaxation, heightened arousal). These effects are strong reinforcers and encourage continued efforts to obtain or ingest the drug. These reinforcing effects may be more critical than the reduction of withdrawal symptoms after periods of abstinence.

Critical to understanding the appetitive model is the idea that negative emotions are not necessarily withdrawal symptoms. However, negative emotions previously alleviated by nicotine may serve as cues for seeking repetition of smoking's reinforcing effects (Stewart, DeWit, Eikelboom 1984). For example, social anxiety may be the occasion for smoking, which is then reinforced by nicotine's ability to reduce anxiety. The anxiety, however, is a response to a stressful situation, not a symptom of withdrawal from cigarettes. Smoking is reinforced by the anxiety reduction, not by reduction of withdrawal symptoms.

The many ways smoking is conditioned to circumstances around it may explain "the thorough interweaving of the smoking habit in the fabric of daily life" (Pomerleau and Pomerleau 1987, p. 119). The sheer repetition of smoking also strengthens such interweaving. It is estimated that the average pack-a-day smoker of 20 years' duration has inhaled cigarette smoke over 1 million times (Fisher and Rost 1986; Pomerleau and Pomerleau 1984), each inhalation providing an opportunity for conditioning smoking to numerous circumstances of daily life. Moreover, with years of smoking, the emotional states and daily circumstances conditioned to it may continue to increase, resulting in urges to smoke being conditioned to almost every circumstance encountered and complicating the task of maintaining abstinence.

Cognition and Decisionmaking

Cognitive and decisionmaking processes play a lesser role in the maintenance of regular smoking relative to the other factors discussed here. Smokers have long believed that they derive positive effects from smoking. The "pros" of smoking have been embodied in the instruments used in decisionmaking studies (Mausner and Platt 1971; Velicer et al. 1985) and in the Horn and Waingrow (1966) Reasons-for-Smoking Scale.

As documented in Chapter 4 of this Report, public knowledge of the health consequences of smoking has increased steadily over the past 25 years. Eighty-seven percent of current smokers now report that they understand that smoking is harmful to their

health (ALA 1985) and two-thirds of high school seniors report "great risk" being associated with pack-a-day smoking (Johnston, O'Malley, Bachman 1987). Why, then, do so many persist in regular smoking? One reason may be that they do not appreciate just how dangerous smoking is. For example, 75 percent of current smokers agreed that smoking is a cause of lung cancer (ALA 1985), while 94 percent of nonsmokers and 90 percent of former smokers agreed to this. For emphysema, the parallel figures were 75 percent of current smokers compared with 91 percent and 90 percent of former smokers and nonsmokers, respectively (ALA 1985). Surveys indicate a general insensitivity to the relative level of risk associated with smoking. Health professionals rated nonsmoking as the first priority among things Americans can do to protect their health. The public rated nonsmoking as 10th, behind such worthy but, for most Americans, less critical behaviors as consuming adequate vitamins and minerals and drinking water of acceptable quality (Fisher and Rost 1986). As discussed below, the health belief model (Rosenstock 1974) requires that smokers believe they are personally vulnerable to a threat before they will be motivated to attempt change. It has been suggested that personalized acceptance ("Cigarette smoking is dangerous to *my* health") always lags behind general acceptance ("Cigarette smoking is dangerous to health") (Fishbein 1977; Lichtenstein and Bernstein 1980; Shiffman 1987) (See Chapter 4). These considerations suggest that many smokers still find it possible to discount the riskiness of their behavior.

Another possible reason for some smokers' insensitivity to smoking risks is that they have not always been given the full message, or they have been given mixed messages, including prosmoking messages (advertising) from the cigarette industry. Factors that impede public awareness and acceptance of the health hazards of smoking include cigarette advertising and promotion and cigarette companies' public relations and lobbying activities, which are also reviewed in Chapters 6 and 7.

Other issues related to persistence of smoking will be covered in the Section on Quitting and Relapse.

Personal Characteristics and Social Context

Personal Characteristics

The 1964 Surgeon General's Report linked smoking in adulthood and adolescence to extraversion, or as it defined it, a tendency "to live faster and more intensely" (US PHS 1964, p. 366), and this relationship has been confirmed in later studies (e.g., Ashton and Stepney 1982). However, reviews indicate that there is no consistent evidence relating smoking to neuroticism or emotional instability (Smith 1970; US DHEW 1979a). More recent studies have continued to find relationships with smoking and behaviors linked to extraversion: coffee and alcohol consumption (Istvan and Matarazzo 1984); circadian phase differences, being an "evening type" as opposed to a "morning type" (Ishihara et al. 1985); alcohol consumption, driving accidents, divorce, frequent job changes, low levels of vocational success, and impulsivity (Eysenck 1980).

Another personality construct that received a great deal of attention earlier in the smoking literature was Rotter's (1966) internal versus external locus-of-control dimension (e.g., Foss 1973; Best and Steffy 1975; Best 1975; Straits and Sechrest 1963). Two general hypotheses characterized work in this area. The first noted that smokers tended to have a more external locus of control, that is, perceive that things occur because of fate, not because of one's own actions, compared with nonsmokers. The second held that smokers with a greater internal locus of control, that is, a perception that things happen because of one's own actions, would be more successful in quitting. A review of this literature revealed inconsistent support for both hypotheses (Baer and Lichtenstein 1988b).

The multidimensional health locus of control scale (Wallston, Wallston, DeVellis 1978) was an attempt to anchor the locus of control construct specifically to health behavior consistent with the trend away from broad, dispositional traits (Mischel 1973). Most studies using this scale examined the effect of health locus of control on cessation attempts. Three investigations reported small but significant prospective relationships between subscales of the Health Locus of Control Scale and maintenance of abstinence (Kaplan and Cowles 1978; Rosen and Shipley 1983; Shipley 1981).

A popular approach to understanding social or psychological problems has been through typologies. Tomkin's typology of smoking and affect regulation was very influential in the 1960s and early 1970s (Ikard and Tomkins 1973; Tomkins 1966, 1968). Tomkins originally proposed a fourfold typology including positive affect, negative affect, habitual, and addictive smoking. This model gave rise to the Reasons-for-Smoking Scale (Horn and Waingrow 1966), which continues to be used widely in public education and cessation programs despite receiving little empirical support (Shiffman 1988). Validity studies have yielded the most consistent support for the negative affect smoking construct (Ikard and Tomkins 1973; Pomerleau, Adkins, Pertschuk 1978; Joffe, Lowe, Fisher 1981).

The support demonstrated for negative affect smoking is also consistent with recent reviews' emphasis on stress reduction as being among those biological effects of nicotine that maintain regular smoking (e.g., Leventhal and Cleary 1980, Pomerleau and Pomerleau 1987). Much evidence for such effects comes from the retrospective reports of relapsers and smokers attempting to stop, which are reviewed later in this Chapter. However, relatively few data demonstrate that heightened stress leads to greater smoking. Among them are Ikard and Tomkin's observations (1973) of greater incidence among race track spectators during horse races—presumed to be times of stress—than in the periods before and after races, and Silverman's observations of nicotine-induced reductions in aggression among rats (1971). A number of other studies reviewed in the 1988 Surgeon General's Report link smoking and negative affect but, as noted in that review, are not conclusive as to whether reduction of negative affect makes a substantial contribution to regular smoking. Design problems include comparisons of smokers smoking with smokers who are deprived, leaving unclear, for instance, whether smoking reduces negative affect or whether, for regular smokers, *not* smoking merely causes an aversive, deprivation state. As concluded in the 1988 Report, ". . . caution must be exercised in generalizing about smoking and nicotine's effects on stress and mood . . ." (US DHHS 1988, p. 405).

Less direct support for effects of stress on smoking lies in studies of smoking prevalence among groups who are disadvantaged in our society, including psychiatric outpatients (Hughes et al. 1986) and male users of soup kitchens (McDade and Keil 1988). Of the 38 subgroups defined by gender and economic, educational, vocational, or marital status listed in the 1988 Report, divorced or separated men had the highest prevalence of smoking, 48.2 percent (US DHHS 1988). Other social problems such as alcoholism and suicide are also more prevalent in this group (Kaplan and Sadock 1985).

Beyond those groups with significant disadvantages such as psychopathology and very low income, the more general effects of income and education are quite substantial. For instance, preliminary data from the 1987 NHIS indicate a 35-percent smoking prevalence among adults with less than a high school education, more than twice the 16.3 percent prevalence among those with postgraduate college training (see Part I). Prevalence among both women and men declines with increases in income range. Among unemployed men, the prevalence is 44.3 percent (US DHHS 1988). Such trends indicate that the social and economic context affects the relationship of personal characteristics with smoking. Consistent with this, trends presented in Part I of this Chapter indicate that observed differences of race and sex are attributable to effects of income and education (see also Novotny, Warner et al. 1988).

Social Context Influences

The arrival at regular use roughly corresponds to the period of transition from adolescence to adulthood. At least until very recently, the social changes that accompany this passage—entering a university, the military, or the workforce—have been associated with a marked change in the acceptability of smoking. For high school students, smoking is often prohibited on school property, even if the prohibition is poorly enforced. In the workforce, community college, and university setting, smoking has been widely accepted. The military until recently had supported smoking among its men and women, as reflected in low prices for cigarettes at military exchanges and commissaries and by the announcement of breaks with "The smoking lamp is lit." The extent to which smoking is a part of the role of the serviceman was shown in a survey of Navy enlisted men with a mean age of 22.6 years and a mean of 3.9 years' service. Seventy-two percent were self-reported smokers (Burr 1984). That the military has an effect on creating rather than attracting smokers is suggested by a comparison of prevalence among naval recruits, 27.6 percent, and shipboard men, 49.8 percent (Cronan and Conway 1988). The military has recently recognized the enormous costs attendant to the high prevalence of smokers within its ranks and has begun efforts directed at reducing the percentage of smokers among its personnel (See Chapters 6 and 7).

Cigarette marketing, discussed above and in Chapter 7, continues to be an important influence encouraging adult smoking, with several possible direct and indirect influences on smoking patterns (Warner 1985).

Summary

The past 25 years have seen a deepening appreciation of the importance of nicotine in maintaining regular smoking. In contrast to the 1964 Surgeon General's Report, cigarette smoking is now defined as an addiction (US DHHS 1988). Earlier emphasis on the maintenance of blood nicotine levels as a means to avoid withdrawal has been balanced by the awareness that nicotine's varied effects make smoking an efficient coping strategy for affect regulation and perhaps weight regulation. Conditioning models of smoking have become more sophisticated and firmly integrated with the pharmacologic actions of nicotine to explain addiction. While the public is now better informed about the health consequences of smoking, many smokers still minimize their perception of their vulnerability amid extensive marketing of tobacco products. Broad, dispositional traits or motives are now seen to be of limited value in understanding smoking. The role of social settings and social influence in encouraging regular smoking is also better understood.

Cessation and Relapse

A large body of literature on determinants of cessation has evolved, driven by the need to provide empirical and theoretical guidelines for intervention programs. All three sets of determinants—pharmacologic processes and conditioning, cognition and decisionmaking, and personality and social context—play an important role in the cessation stage (Table 39). It is with respect to cessation, especially, that the concept of stages—treating stopping as a process over time—has evolved (Figure 8) and now guides research and interventions (e.g., Marlatt 1985). The influential and well-articulated cessation stage model of Prochaska and DiClemente (1983) defines four stages of cessation. Precontemplation is the stage in which the smoker is neither considering stopping nor actively processing smoking-and-health information. During the contemplation stage, smokers are thinking about stopping and are processing information about the effects of smoking and ways to stop. In the action or cessation stage, the smoker is no longer smoking and has been without cigarettes for less than 6 months. The maintenance phase involves establishment of long-term abstinence, while relapse is the resumption of smoking. When relapse occurs, the smoker recycles to any one of the three previous stages.

Specific cognitive and behavioral processes are employed during the different stages of cessation (Prochaska and DiClemente 1983). Determinants of each stage are also different. Thus, factors that affect an initial decision to stop smoking may not predict success in stopping or sustained maintenance after stopping. Working from a related but different stage model—initial decision, initial control, maintenance—Rosen and Shipley (1983) used health locus of control, desire to stop, and self-esteem to predict self-initiated smoking reduction. Using regression analysis, a different set of predictors was demonstrated at each stage, suggesting the possible need for different intervention techniques at each stage of the smoking reduction process.

An important implication of a stage model is that interventions may need to address cessation's several stages. The precontemplator's tendency to ignore quitting strategies

may need to be met with continued personalized information on smoking and health; the contemplator may need social support to attempt cessation; and the abstainer may need help that emphasizes the development of relapse prevention skills. There are as yet no data available to demonstrate the effect of interventions tailored to specific stages of cessation. Thus, a model like the Prochaska and DiClemente stage model is best viewed as a tentative conceptualization, useful for guiding research and interventions. The next section considers changes in our understanding of the determinants of cessation in relation to the stages in the cessation process.

Pharmacologic Processes and Conditioning

Pharmacologic processes and conditioning exert a strong influence on the process of quitting. One indicator of the role of addiction is that heavier, more dependent smokers in intervention programs are less likely to quit than are lighter, less dependent smokers (e.g., Hall et al. 1984; Ockene et al. 1982b), especially when smokers with much variability in baseline smoking are studied, as in the Multiple Risk Factor Intervention Trial (MRFIT) (Hughes et al. 1981). As is noted in the 1988 Surgeon General's Report, "Withdrawal symptoms, whether elicited by acute deprivation or by conditioned stimuli, are hypothesized to be the link between dependence and relapse" (p. 523), although some analyses (e.g., Niaura et al. 1988) place greater emphasis on positive effects of smoking in motivating relapse. Further evidence of the influence of addiction comes from intervention studies evaluating nicotine-containing gum. Several studies have found that nicotine polacrilex gum is more effective when used with nicotine-dependent smokers (as measured by the Fagerstrom (1978) addiction questionnaire) than with less dependent smokers (Hall et al. 1985; Killen et al. 1984; Schneider et al. 1983). Nicotine polacrilex gum most likely is effective because it reduces withdrawal symptoms frequently noticed in the first days and weeks of abstinence (Hughes et al. 1984; West et al. 1984). Recently, more work has focused on nicotine replacement strategies or other pharmacologic treatment adjuncts reflecting the importance of biological factors in smoking and cessation (Grabowski and Hall 1985; US DHHS 1986b; US DHHS 1988).

Conditioning mediates the role of the pharmacologic effects of nicotine in cessation. As noted in the discussion of regular smoking, numerous conditioned environmental stimuli are likely to evoke urges or cues to smoke. Recent work by Abrams and colleagues demonstrates that former smokers manifest psychophysiological reactivity to smoking cues long after they have quit (Abrams et al., in press; Abrams 1986). Conditioned reactivity to environmental cues, then, may be more decisive in the later stage of maintenance after withdrawal symptoms have subsided.

Research on relapse triggers reflects current interest in specific, situational variables. Primary triggers include stress, interpersonal conflict, dysphoria, presence of other smokers, and alcohol consumption (Marlatt and Gordon 1980; Shiffman 1982). Although the data are primarily retrospective reports from relapsed or tempted subjects, there is convincing consistency on the importance of stress and negative affect in determining maintenance or relapse (Baer and Lichtenstein 1988a; Marlatt and Gordon 1980; Ockene et al. 1982a; Shiffman 1982; US DHHS 1988). The mechanism whereby

a lapse becomes a full return to smoking has also recently been analyzed as a series of stages (Marlatt 1985). These include a high-risk occasion that triggers a smoking lapse (that is, a brief return to smoking) and a subsequent interpretation of the lapse that may lead to abandoning the cessation effort and a return to regular smoking. Much recent attention has been paid to the importance of coping responses in dealing with both high-risk situations and lapses (e.g., Shiffman 1984; Shiffman and Wills 1985). The available data suggest that the absence of any coping response is predictive of relapse but there are few differences that relate to the use of specific coping strategies used (Shiffman 1984).

Cognition and Decisionmaking

The role of cognitions in smoking cessation is evident in the relapse model noted above (Marlatt 1985). In this model, a lapse diminishes self-efficacy or self-confidence and expectations for long-term success. These diminished efficacy expectations then become the basis for an individual to abandon the effort and return to regular smoking (Marlatt 1985). In fact, lapses are highly predictive of subsequent relapse (Brandon, Tiffany, Baker 1986; Baer et al. 1988).

Researchers have long noted the relationship of knowledge about the health consequences of smoking, beliefs about personal susceptibility, attitudes toward smoking, and expectations about the benefits of quitting to cessation efforts and their long-term success or failure. Cognitive-behavioral models of smoking cessation emphasize the importance of an individual's interpretation of health risks and perceived self-efficacy for refraining from smoking (Pechacek and Danaher 1979), as well as attributions about addiction and lapses during the maintenance stage (Marlatt 1985).

Expectancy-Value Models

Expectancy-value models have guided approaches to smoking cessation for many years (e.g., Kirscht 1983; Mausner and Platt 1971; Sutton 1987). Outcome expectations refer to expected consequences that would occur if one continued smoking or quit smoking (Bandura 1977). Their value refers to the personal importance or weight given to the various possible outcomes and can be extended to perceptions about what significant others wish one to do (Fishbein 1982). Expectations include the positive (e.g., enjoyment) and negative (e.g., disease) consequences of smoking and the positive (e.g., enhanced lung capacity) and negative consequences (e.g., loss of enjoyment, withdrawal symptoms) of quitting. Expectancy-value models tend to assume that human behavior is rationally guided by logical or at least internally consistent thought processes (Henderson, Hall, Linton 1979).

Decisionmaking models represent one variant of the expectancy-value approach and have been (e.g., Mausner and Platt 1971) and continue to be (Velicer et al. 1985) applied to smoking cessation. The more recent applications (Velicer et al. 1985) may prove more useful because they take into account stage of change (Prochaska and DiClemente 1983). Changes in the relative level of pro and con views of smoking, for example, appear related to stages of quitting. Smokers not contemplating quitting report substantially higher levels of pro than con views, while those contemplating quit-